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PROGRESS REPORT

DESIGN AND DEVELOPMENT OF KLYSTRON OSCILLATOR V-39 AND V-40

For Period: 1 April to 30 April 1953

Prepared for

Bureau of Ships Navy Department

on

BUSHIPS CONTRACT NObsr-52105
Index No. NE 110244

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PURPOSE

The purpose of the program engaged under BuShips Contract No. NObsr-52105 is to design and develop two wide-range klystron oscillators, V-39 and V-40, which will comply with the specifications outlined in this contract.

The two oscillators will cover the frequency band from 10 to 21 kmc. One tube will tune over the lower half of the band from 10 to 15.5 kmc, and the other will cover the band from 15 to 21 kmc. Preliminary design tubes of each type, complete with electrical test and characteristic data, will be furnished. In addition, five tubes embodying the final design of each type will be supplied, along with electrical characteristics and test data, final proposed specifications, and manufacturing drawings.

PROGRESS

Five V-39 tubes and five V-40 tubes were completed this month. The V-39 tubes had single-piece reflectors, and no bias was required on the cathode focus. All but one of the V-40 tubes had single-piece reflectors and cathodes which required no focus voltage; one V-40 (tube No. 52) required negative cathode focus voltage. Data were taken of these 10 tubes, with 750 volts of beam voltage applied and two reflector modes used to cover the tuning range. Table 1 gives the optimum power output over the tuning range of each tube plus any applicable comments concerning tube performance or status.

TABLE 1

Tube No.	Power Output (mw)	Remarks
(a) V-39 Tubes		
13	50	830 v beam voltage.
14	75	
15	100	Tube on loan to Hewlett-Packard Company and Bureau of Ships.
16	—	Tube lost in manufacture.
17	90	Tube went down to air.
(b) V-40 Tubes		
52	125	-40 v cathode focus voltage.
53	—	Tube required use of 3 reflector modes to cover band. Hole was found in reflector grid.

TABLE 1 (CONT.)

Tube No.	Power Output (mw)	Remarks
54	--	Tube required use of 3 reflector modes to cover band.
55	70	
56	--	Tube lost in manufacture.
57	--	Tube lost in manufacture.
58	200	

V-40 tube No. 52 had a small output iris and was highly undercoupled. The other V-40 tubes had a larger output iris, and the power into a matched load was approximately the same as the power into an optimum load at 21 kmc.

Figures 1, 2, 3, and 4 show the power output as a function of frequency for tubes No. 15, 17, 55, and 58, respectively.

Work was continued on the mode suppression problem, particularly as applied to the V-39. The operation of the mode suppressors used with the V-39 requires that the waveguide forming the mode suppressor either have a cut-off frequency higher than the frequency of the λ mode or that the plunger cover the coupling iris when the cut-off frequency is below the frequency of the λ mode. Two of these mode suppressors are required on average or weak tubes, but a third suppressor is required on the best tubes. Mode interference between the $\lambda/2$ and λ cavity modes still exists when the frequency of the λ mode is about 14 kmc.

Several shorting plungers were made for use in the external cavity of the V-40. An interesting feature of V-40 tubes No. 55 and 58 is that all the undesired cavity modes can probably be suppressed since the $\lambda/2$ cavity mode oscillates at approximately 14.7 kmc when the λ mode is at 21 kmc. A simple steel screw inserted in the cavity near the tube suppresses the $\lambda/2$ mode at the critical interfering point.

One V-39 (tube No. 15), complete with mode suppressors, and one V-40 (tube No. 51), built in March without mode suppressors, were shipped to the Bureau of Ships on loan for evaluation tests on 15 April 1953.

Four V-39 tubes and six V-40 tubes are under construction at the present time.

PROGRAM FOR NEXT INTERVAL

Construction and testing of additional V-39 and V-40 tubes will continue during the next interval. Work on the mode suppression and matching problems of these tubes will also be continued.

Estimated expenditures during April 1953: $11,000.00

Estimated man-hours during April 1953: 1400

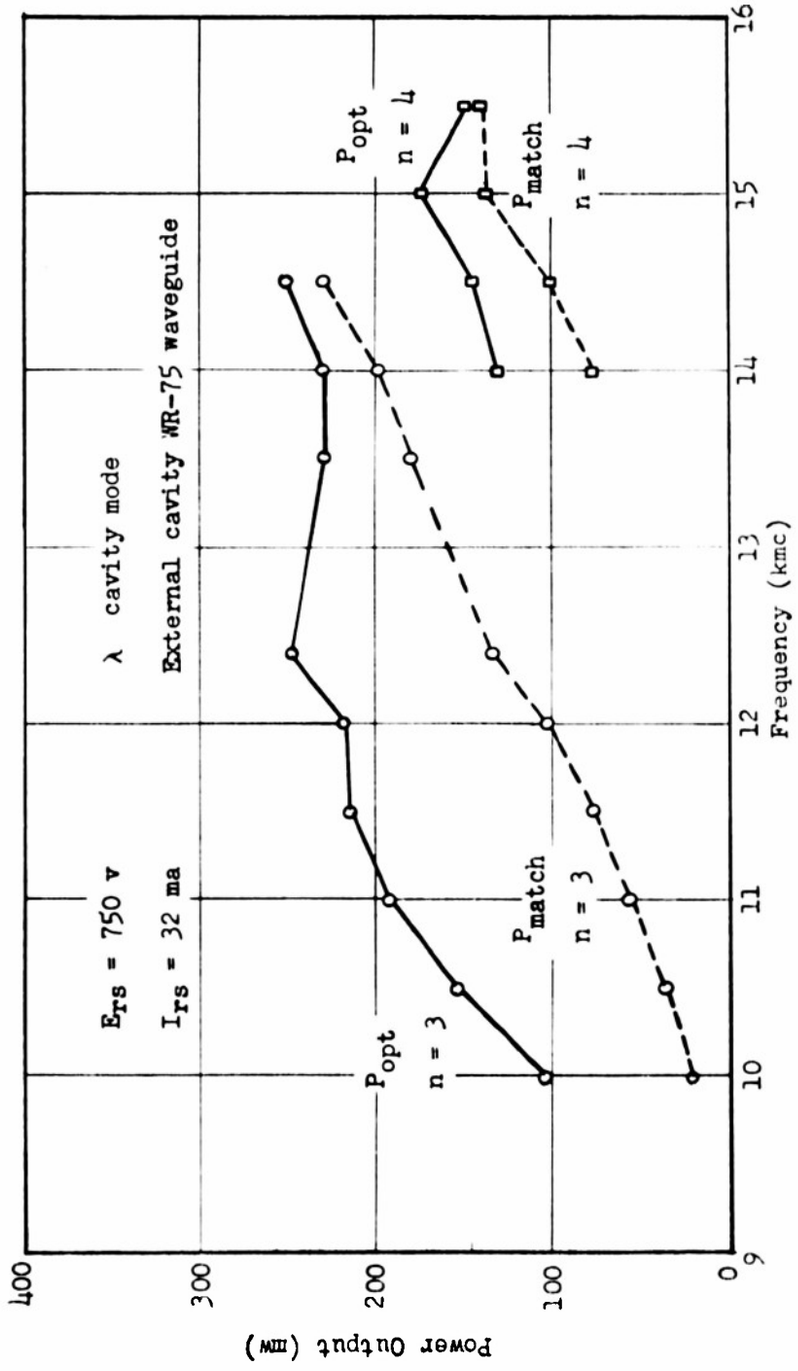

FIGURE 1

POWER OUTPUT vs. FREQUENCY FOR V-39 TUBE NO. 15

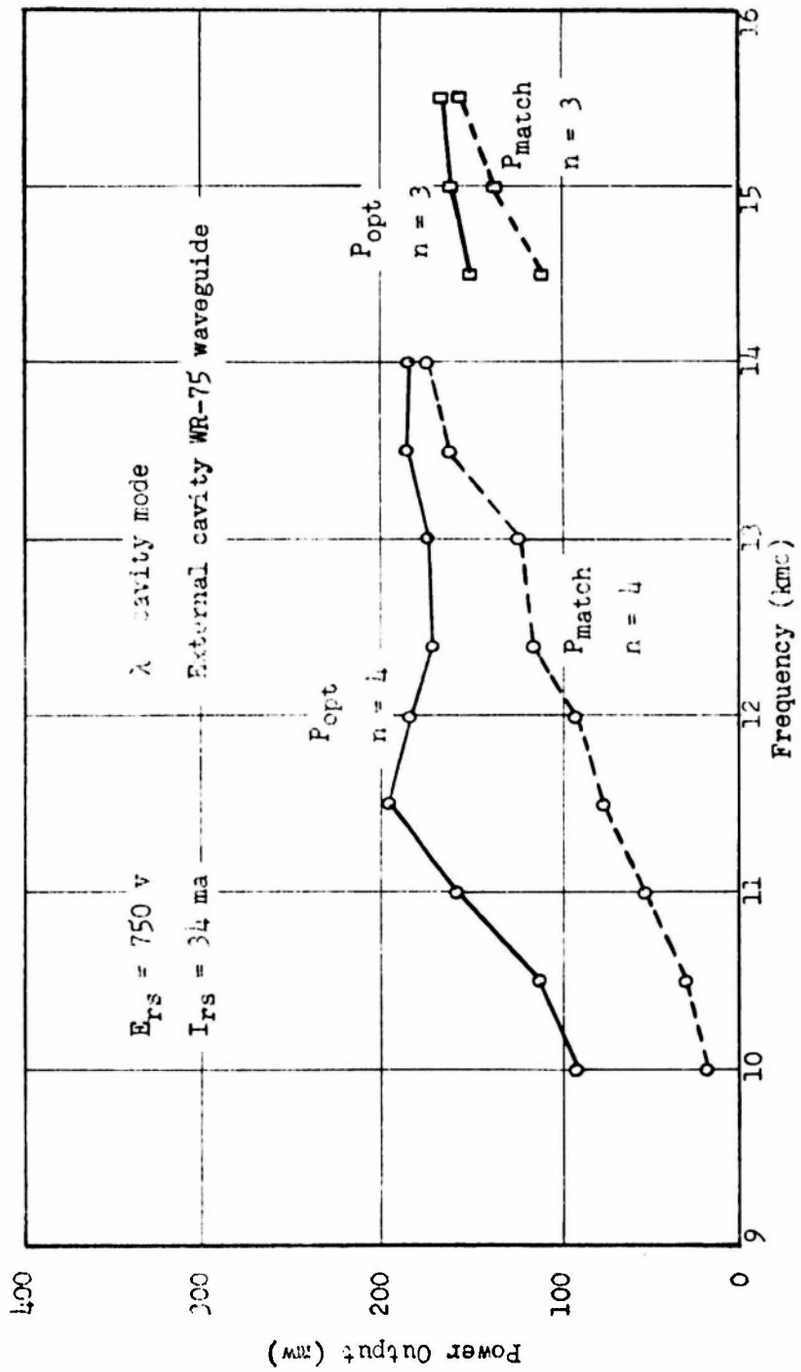

FIGURE 2

POWER OUTPUT vs. FREQUENCY FOR V-39 TUBE NO. 17

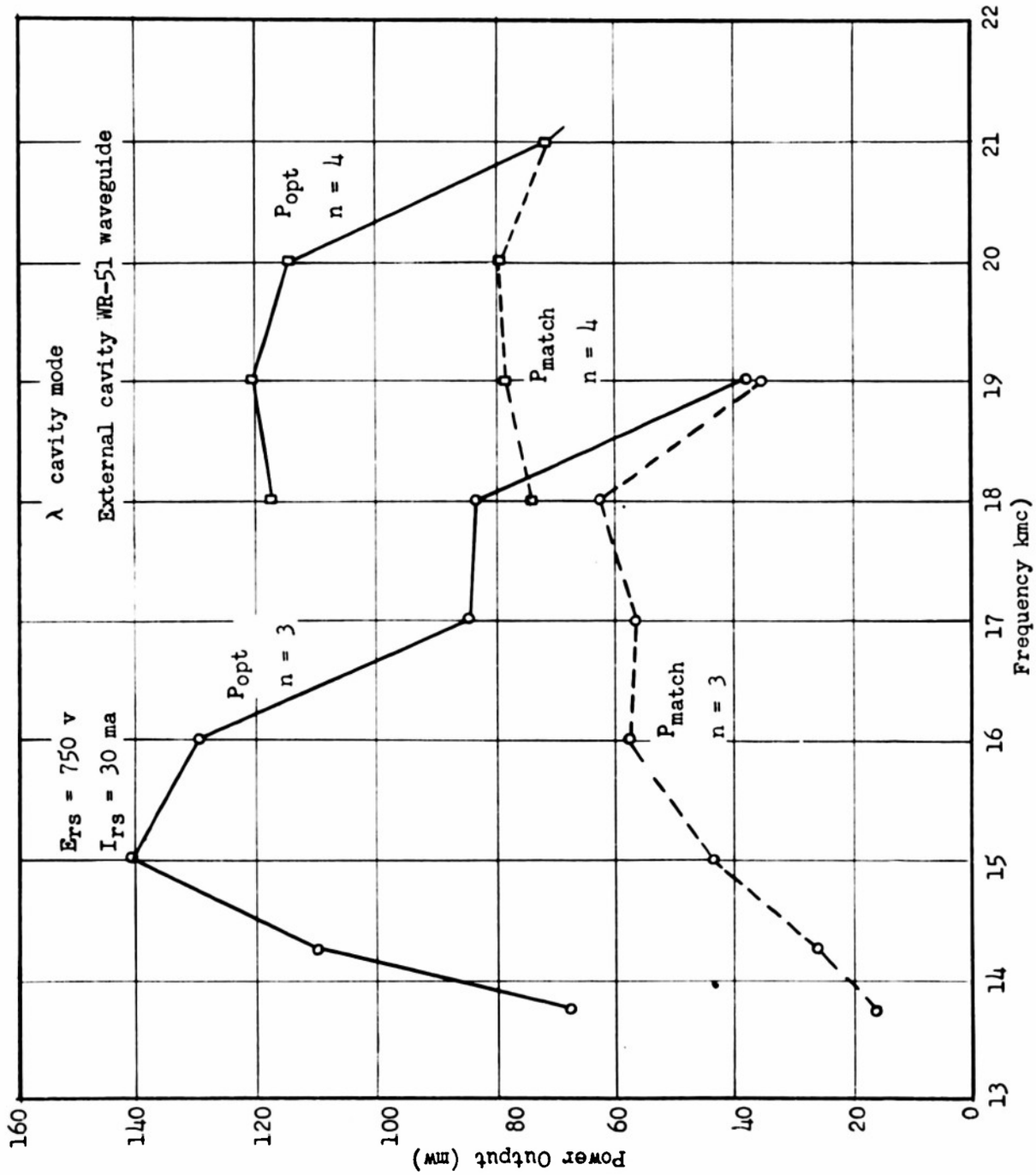

FIGURE 3

POWER OUTPUT vs. FREQUENCY FOR V-40 TUBE NO. 55

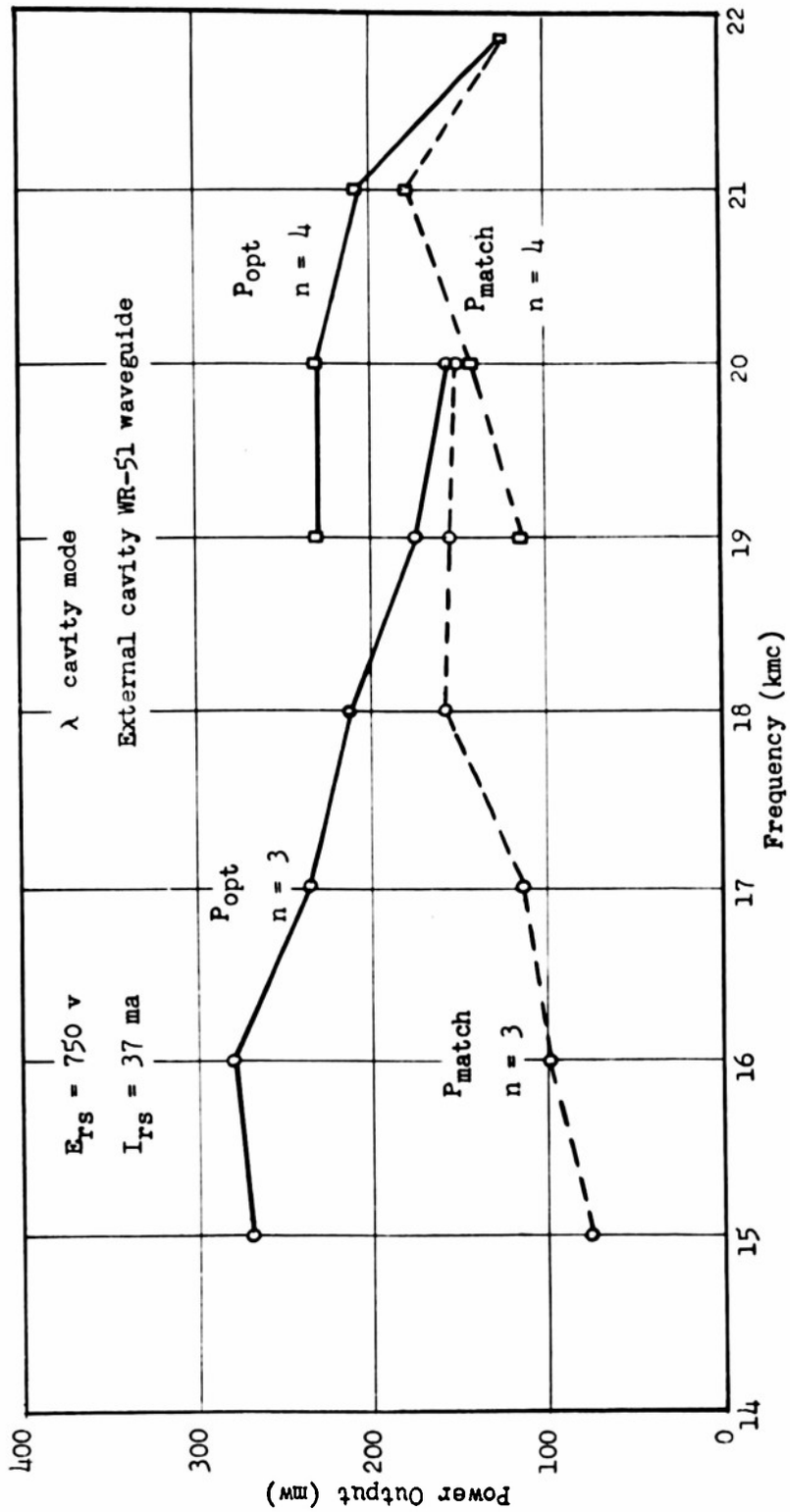

FIGURE 4

POWER OUTPUT vs. FREQUENCY FOR V-40 TUBE NO. 58

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